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ENTOMOLOGICAL OBSERVATIONS ON FANNING AND WASHINGTON ISLANDS, TOGETHER WITH GENERAL BIOLOGICAL NOTES

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The equatorial coral islands of the mid-Pacific Ocean offer much of interest to the biologist. They are for the most part unstudied biologically, being off the main routes of travel and generally more or less difficult to approach. The rather isolated group with which we are concerned in this paper consists of the following small islands: Christmas, nearest the equator, Fanning, Washington and Palmyra, extending from Lat. 1° 57′ to 5° 49′ North and Long. 157° 27′ to 162° 11′ West. With the exception of the latter, this group is governmentally a part of the Gilbert and Ellice Islands (British), and the inhabitants are mainly Gilbertese.

The group was visited by the writer during the summer of 1924, and the voyage was made on a copra vessel, a small British motor schooner, under sail practically the entire distance from San Francisco to Fanning Island. The trip required twenty-three days. The stay on the islands lasted about three months, very largely on Fanning, affording an unusual opportunity for the study of its fauna and flora. On the return trip the Hawaiian Islands were visited, adding much to the value of the investigation because of the opportunity to compare certain material in hand with collections in Honolulu, both from the Hawaiian Islands and the Society Islands, about midway between which the islands under consideration are situated, i. e., separated from these groups by distances of from about 850 to 1200 miles.

Fanning Island is a typical coral atoll, consisting of a narrow rim of land hardly three-fourths of a mile wide at the most and enclosing a very beautiful lagoon, opening into the ocean at three points, thus forming in reality a circle of three narrow islands. The entire island is approximately ten and one-half miles long by five and one-half miles wide, with an external

circumference of about thirty-one miles. It comprises about 8500 acres, of which over 3200 acres are in coconuts. Washington Island is about four and one-half miles in length by one and one-half miles wide, with an external circumference of about ten miles. This island encloses a shallow fresh-water lake about two miles long, with an average width of about half a mile. The highest elevation of either of these islands is not over twelve feet. Since practically all of our collecting was done on these two islands, a description of the other islands will be omitted.

The total annual rainfall for Fanning Island for 1918 was slightly over 102 inches, for 1923 it was slightly over 66 inches, and for the first eight months of 1924 it was above 55 inches. The temperature ranges from about 78° F. at night to about 85° F. at noon, with very little variation throughout the year, except an occasional day when more than 90° F., or a night when 70° F. may be reached. The annual mean temperature is slightly in excess of 81° F. The humidity is seldom below 70.

As might be expected, the flora of these coral islands is very meager in species, although the vegetation in some places presents tropical luxuriance, notably on Washington and Palmyra Islands. The writer and an assistant collected forty-six out of the fifty-four known species of plants from this group of islands, only two small collections having been made previously. Of this total number of species, eleven have been introduced purposely, among them *Cocos nucifera* Linn., *Musa sapientum* Linn., *Artocarpus communis* Forst., *Carica papaya* Linn., and *Hibiscus rosa-sinensis* Linn. Fourteen species have been accidentally introduced, among them *Euphorbia hirta* Linn., *Euphorbia prostrata* Ait., *Sida fallax* Walp and *Vernonia cinerea* Less.

According to Dean E. D. Merrill, who identified all the species collected by the writer, about twenty-nine may safely be considered as native species. Most of the bush, which in some places forms almost impenetrable thickets, consists of such native species as the Umbrella (*Tournefortia argentea* Linn. f.), which may reach the height of great trees, Buka (*Pisonia grandis* R. Br.), also occasionally occurring as tall trees, and Nashu (*Scævola kœnigi* Krause). The screw pine (*Pandanus tectorius* Sol.) is also a conspicuous part of the vegetation in

some parts of the islands. The coconut, however, dominates all, and is never out of sight.

With this rather poor flora as a basis for support, the number of species of insects dependent directly or indirectly on plant food is naturally not very great, but the paucity in the number of species is generally well balanced by the abundance of individuals in a given species, notably ants. The same thing may be said relative to the fauna in general. The number of species of native birds is relatively small, there being only thirteen species on these islands (eleven sea birds, and two land birds) exclusive of migrants. The number of individuals is, however, very great and at times the sky is literally clouded with birds, almost wholly fish-eating. The noddy tern (*Anous stolidus*) is most numerous, and three species of boobies (*Sula leucogastra, Sula dactylatra* and *Sula piscator*) occur in abundance, while the booby's arch-enemy, the man-o'-war hawk or frigate bird (*Fregata minor palmerstoni* is ever present. A rare species of paraquet (*Vinus kühlii*), a most exquisite creature is rapidly growing less in numbers, though still fairly abundant. The very beautiful tropic bird or bo's'n bird (two species, *Phæthon lepturus* and *Phæthon rubricauda*) is fairly common in this region.

The ground almost everywhere is full of crab holes, and as one approaches these, the ludicrous omnivorous land crab (*Cardisoma obesum*) sidles away and disappears in its burrow. Hermit crabs (*Cœnobita rugosa*) are exceedingly abundant and pestiferous, apparently attacking almost anything. The so-called coconut crab (*Birgus latro*), a large and powerful species, is rapidly becoming extinct, but may still be seen climbing coconut trees at night, hiding in holes in the ground and cavities of trees during the day. Two species each of gheckos and skinks, usually measuring not over five or six inches in length, are remarkably abundant, and their rather large, white eggs are frequently encountered in pockets in the rough trunks of the coconut trees and elsewhere.

Rats (*Epimys alexandrinus*) are very numerous and a serious pest to the coconut industry.

During the practically three months' stay on these islands much time was given to the study of coconut pests, particularly the Tahiti coconut weevil (*Diocalandra taitensis* Guerin). Rela-

tively little time remained for much else, however, spare hours were diligently spent in making collections. Although many insects were collected and safely brought to Berkeley in pill-boxes, the total number of species taken is quite disappointingly small, namely, only about ninety.

These ninety species are distributed somewhat as follows, with probable corrections after all the material has been carefully checked up:

Coleoptera, 31 species, included in the following families: Staphylinidæ (2), Hydrophilidæ (1), Cleridæ, (1), Nitidulidæ (1), Cucujidæ (2), Dermestidæ (1), Cryptophagidæ (1), Ostomidæ (1), Coccinellidæ (1), Elateridæ (3), Odomeridæ (4), Tenebrionidæ (3), Scarabæidæ (1), Cerambycidæ (1), Anthribidæ (1), Curculionidæ (5), Scolytidæ (2).

Diptera, 12 species, included in the following families: Culicidæ (2), Tipulidæ (2), Dolichopodidæ (2), Ortalidæ (1), Sarcophagidæ (1), Muscidæ (1), Calliphoridæ (2), Hippoboscidæ (1).

Hymenoptera, 10 species in the following families: Apidæ (1), Formicidæ (7), Evaniidæ (1), Chalcididæ (1).

Hemiptera, 8 species in the following families: Pentatomidæ (1), Cydnidæ (1), Miridæ (1), Nabidæ (1), Coccidæ (4).

Orthoptera, 8 species in the following families: Blattidæ (5), Tettigoniidæ (1), Gryllidæ (1), Forficulidæ (1).

Lepidoptera, 7 species in the following families: Noctuidæ (4), Sphingidæ (1), Nymphalidæ (2).

Isoptera, 2 species.

Mallophaga, 3 species.

Anoplura, 1 species.

Odonata, 3 species.

Thysanura, 2 species.

BUTTERFLIES

Although one specimen of the milkweed butterfly (*Danaus archippus*), taken on Fanning Island, appears in my collection, the specimen having been given to my assistant, Mr. Kirby, by a native, none was actually seen by either of us, and the presence of this one specimen is rather puzzling. On the other hand, the beautiful *Hypolimnas bolina* Linn. occurs rather abundantly, though restricted in range, in certain localities on Fanning. I took all three color phases during my stay on this island. So

far as I know, the sole food plant of the larvæ on this island is *Sida fallax* Walp, an accidentally introduced weed called "kaura" by the native Gilbertese.

The natives were greatly impressed by the fact that the writer reared in his room the beautiful "tebuba" (butterfly) from the ugly "worm" which feeds on the "kaura." Although I do not know how long the larval period is, the pupal period is quite short, for example, two caterpillars pupated Sunday, June 8 (1924), between 8:45 a. m. and 9 a. m., and emerged early Monday morning, June 16, giving a pupal period of eight days. The type locality for this species is the Indo-Malayan region. It occurs in Madagascar and western China.

MOSQUITOES

Mosquitoes (*Aedes*) were very abundant and annoying on Washington Island where they breed primarily in the rain receptacles, from which the water is taken for drinking and general domestic purposes. The natives dig shallow water holes, "temanipa," in which mosquitoes (*Culex*) breed in enormous numbers, particularly on Fanning, where these water holes are of frequent occurrence.

HEAD LICE

Head lice (*Pediculus capitis*) are very abundant among the native Gilbertese. These lice are distinctly brownish black in color, as may be seen from the specimens taken from natives on Fanning Island. The lice are considered a delicacy by the natives. If it were not so disgusting, I might go into considerable detail to describe the instances in which I witnessed the evidently joyous tête-a-têtes in which this form of delousing was in progress.

TERMITES

Two species of termites were taken on Fanning Island, namely, *Kalotermes immigrans* Snyder, a Hawaiian species, and *Cryptotermes hermsi* sp. nov. (named by Kirby [1]). Only one nest of the former was found in which these insects were tunneling in the hard wood of a prostrate log of Tournefortia, the Umbrella tree. The second species was common and abundant in decayed logs and stumps of coconut and Tournefortia.

Cryptotermes hermsi Kirby is a close relative of the Oriental

1 Kirby, Jr., Harold, 1925. Cryptotermes hermsi sp. nov., a termite from Fanning Island. University of California Publications in Zoölogy, Vol. 26, No. 23, pp. 437-441. Twelve figures in text.

termites and is interesting because of its occurrence on Fanning and its absence both from the Hawaiian Islands and Australia, with which Fanning Island has maritime contact. This species is said to differ markedly from *Cryptotermes primus* Hill of Australia, and even more decidedly from *Cryptotermes piceatus* Snyder of the Hawaiian Islands. It is closely related to *Cryptotermes kotoensis* Oshima, an Oriental species.

BLISTERING BEETLES

Shortly after boarding the vessel which was to take me to Fanning Island, I was told about a beetle which blisters on contact, and is very common. Not long after my arrival I learned from experience that this was the case. Myriads of individuals of two species of *Sessinia* swarm about the newly opened male flowers of the coconut, feeding on pollen. These two species are *Sessinia collaris* (Shp.) and *Sessinia decolor* Fairm., both of which are locally called coconut beetles. Both of these species were readily attracted by a strong electric light, which was led from the ship to the land for the purpose of collecting insects. *Sessinia decolor* certainly causes severe blistering if, for example, it is slapped when crawling on the forearm while collecting specimens. A specimen came in contact with my forearm on the evening of May 20 (1924) and was rather lightly brushed away, but the following day a large blister appeared, measuring about three-quarters of an inch in length by one-quarter inch in breadth, considerably elevated and filled with clear liquid. I opened the blister and applied iodine. The blister did not cause any appreciable pain.

A more detailed study of the species of insects taken on these islands is in progress and will be published shortly, together with observations concerning their geographical distribution.

NOTE ON OPUNTIA INSECTS

Doctor H. G. Dyar has just indicated the identity of "Melitara sp.," page 5, Vol II, this journal. For this form the name, *bollii* Zeller, is available, but Doctor Dyar considers it advisable to treat it as a variety of the Florida *prodenialis* Walker. The Florida form is, then, *Melitara prodenialis prodenialis* Walker, while the Texan "Melitara sp." is *Melitara prodenialis bollii* Zeller.—J. C. Hamlin.